A Biomechanical View of Maxillary Denture Position

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A fundamental determination in orthodontic diagnosis is the delineation of the anteroposterior relation of maxillary and mandibular denture bases. With excessive disharmony of the apical bases, limitations are recognized in orthodontic therapy. Moving teeth off apical bone, or basal bone as it is sometimes called, invites relapse.[5]

Although many clinical methods have been used to measure apical bases, the most informative, objective, and reproducible tool is the cephalometric analysis.[1] The anterior limit of the maxillary apical base is generally accepted to be defined by A point; A point, however, has no generally accepted definition.

Downs[2] defined point A (subspinale) as the deepest point on the premaxilla between the anterior nasal spine and prosthion as viewed on a cephalometric head plate. However, the nasal spine thickness will determine the anterior limit of the observed image. This means that a spiny, bony projection which is not considered to be part of the basal or apical bone is defining A point. Moreover, the spiny thickness and configuration differs in various individuals. Kalafa found no relationship between thickness of bone in the midline, which classically defines A point, and the thickness of bone over the central incisors.[7] Clinically, many orthodontists palpate the alveolar bone on either side of the nasal spine at the base of the nose to avoid this pitfall. Thus, the correlation between the X-ray image and A point is not capable of being closely scrutinized.

The next most widely used definition of A point was created by Jarabak[3] who was aware of the problems created by the nasal spine. He defined A point as a location two millimeters anterior of the apex of the central incisor. The two millimeter measurement is supposed to correspond to the thickness of alveolar bone in this region. Therefore, nasal spine projection will not influence his measurement. However, we are aware that the labial inclination of teeth will influence such a measurement, because the perverted angulations seen in many of our malocclusions alter the normal position of the apex and crown. With the center of rotation of these teeth in the coronal third of the root, the crown is moved in one direction and the root in the other. Many times we have seen lip and thumb habits greatly direct the angulation of incisors to the labial or lingual.

To summarize briefly, the location of A point as the anterior limit of the denture base is a desirable goal, but its present determination is dependent on nasal spine and/or axial inclination of the teeth. Is there a better way to define the anterior limit of the denture base? I would propose that a measurement of the center of resistance of the maxillary central incisors would determine most accurately the anterior limit of the maxillary denture base. I would also suggest that we rethink our concept of basal bone and apical base.

Historically, basal bone was to represent the biological "base" over which teeth must be kept to avoid relapse. Limits of expansion were defined by basal bone. Such bone was not defined, nor could it be because histologically "basal" bone as a distinct entity cannot be described. In other words, basal bone is a concept contrived by the den-

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tal profession for which there is no anatomic justification.[4] If we saw relapse, teeth were moved off the basal bone; if the denture did not show shifting, we had not moved teeth off the basal bone.

There is another inconsistency in our thinking: A point represents a limit of basal bone. Although we theoretically agree that basal bone cannot be altered, most orthodontists look for changes in A point as a result of treatment proving that A point really reflects incisor position.

If we wish to use any point to help us in the definition of anteroposterior maxillary and mandibular denture bases, we should use directly a point representative of the anterior portion of the denture rather than of variously defined bony measurements which indirectly mirror the tooth positions. The point should be independent of axial inclination of the teeth since we know many of our patients with malocclusions have teeth with significant tipping.

With nongeometric shaped objects like rocks, the center mass could be considered one point representative of the entire rock. Teeth, however, have no mass in any realistic sense. Actually, the center of resistance of the tooth represents that point of bodily position of the tooth. The center of resistance is located one third the distance from alveolar crest to the apex.[6] If a line of force passes through the center of resistance, the tooth moves "bodily" along the direction of the line of force. The center of resistance is independent of tooth position and, in the incisors, corresponds very closely to the center of rotation when simple forces like lip, thumb, or tongue are considered.

Intuitively, we use the concept of center of resistance in other areas of orthodontic diagnosis. Crossbites are usually judged to be skeletal or dental in origin by viewing dental casts in an occlusal direction and determining whether teeth are tipped or bodily in crossbite. Burstone, in his determination of midlines, uses an AP film to clarify when incisors are tipped mesiodistally. He locates a point one third the distance from alveolar height to root apex which is the center of rotation of these teeth. In this way he determines midlines more accurately.

If we use the center of resistance of the maxillary central incisors to represent the anterior limit of the denture base, we would measure one third the distance from the cemento-enamel junction to the root apex. This point would be more posterior than A point when viewed in relation to a standard cranial reference line.

Discussion

I propose that the anterior limit of denture base be redefined as a point one third the distance from CEJ to root apex. We could consider this point as our familiar A point, or we could give it a new name if we are comfortable with the limitations of A point. This new determination should reduce the variability of the ANB angle due to perverted angulations of teeth since it tends to negate tipping changes and deals instead with the bodily positions of the teeth or center of mass of the incisors. Furthermore, bony spine configuration will have no effect on the measurement of A point as I have defined it.

A logical extension of our thinking of A point as a tooth related measurement must ultimately also involve the Wits analysis in which A and B points are related to the plane of occlusion rather than a cranial landmark.[8] Suffice it to say that clockwise or counterclockwise rotation of the jaws, as well as the anteroposterior position of nasion, radically affects the ANB angle.

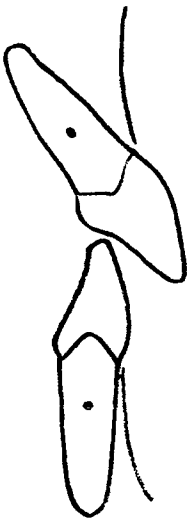

Fig. 1 Class II/1 case with flared maxillary incisors and retroclined mandibular incisors showing basic harmony of denture base as measured by centers of resistance, and disharmony as measured by the ANB angle.

Tipping does not tax anchorage as greatly as bodily tooth movement because the root apices move in opposite directions to the crown. The root movement facilitates the crown movement. Thus, we are able to treat rather quickly a Class II, Division 1 case where lip or other habits have retroclined mandibular incisors and flared maxillary incisors. In such a case, measurement of the center of resistance of the incisors would reduce the ANB angle (Fig. 1), and we would have a better indication of denture base disharmony.

In a Class III where the upper incisors are proclined excessively and mandibular incisors are retroclined to try to accommodate a proper anterior denture relationship, measurements related to the center of resistance would increase ANB difference and more accurately reveal the skeletal overtones (Fig. 2). Furthermore, since we are measuring the position of the anterior denture base, we have a truer indication of treatment effects on the dentition.

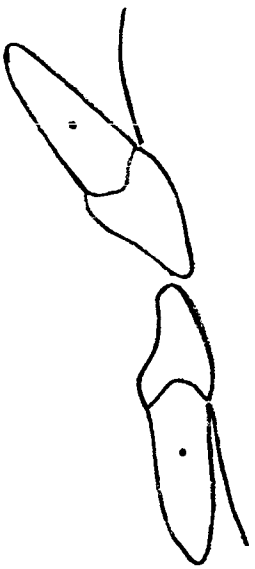

Fig. 2 Class III case with proclined maxillary incisors and retroclined mandibular incisors showing greater denture base disharmony measured with centers of resistance than with the ANB angle.

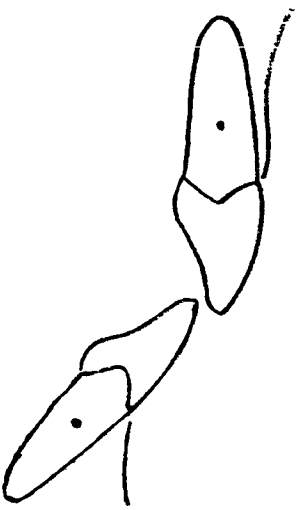

Fig. 3 Treated Class II/1 with retroclined maxillary incisors and flared mandibular incisors showing normal overjet and overbite but little correction of denture base relationship.

In Figure 3 a treated Class II, Division 1 case is shown with retroclined maxillary incisors and flared mandibular incisors showing normal overjet and overbite but little correction of denture base relationship.

In summary, most of us are familiar with the problems with the conventional measurement of A point. I have suggested a new determination of A point which more accurately defines anterior denture base.

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